OTPORNOST MATERIJALA

VEŽBE BR. 5

SMICANJE

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FORMULE

- Ako se predpostavi da su tangencijalni naponi jednoliko raspoređeni po poprečnom preseku, onda se dimenzionisanje vrši po obrascu:

$$\tau_s = \frac{F}{A} \leq \tau_{doz}$$

$$A \geq \frac{F}{\tau_{doz}}$$

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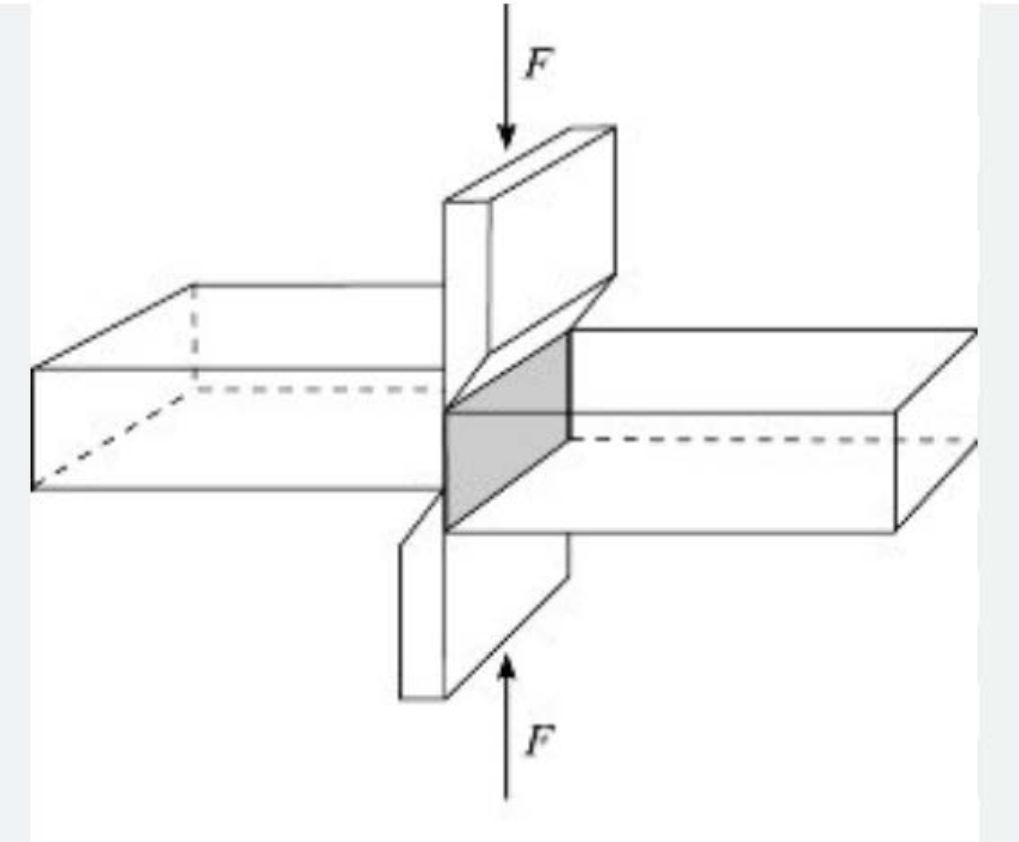
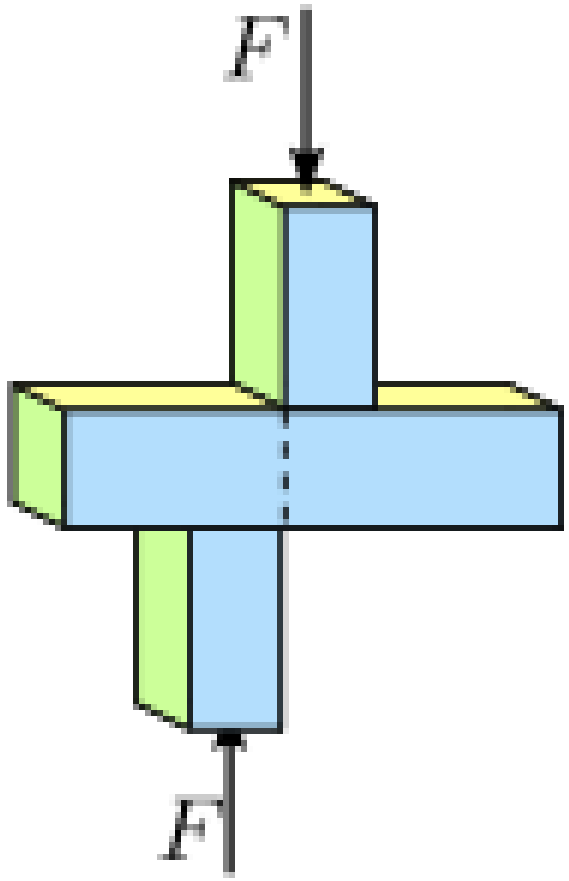
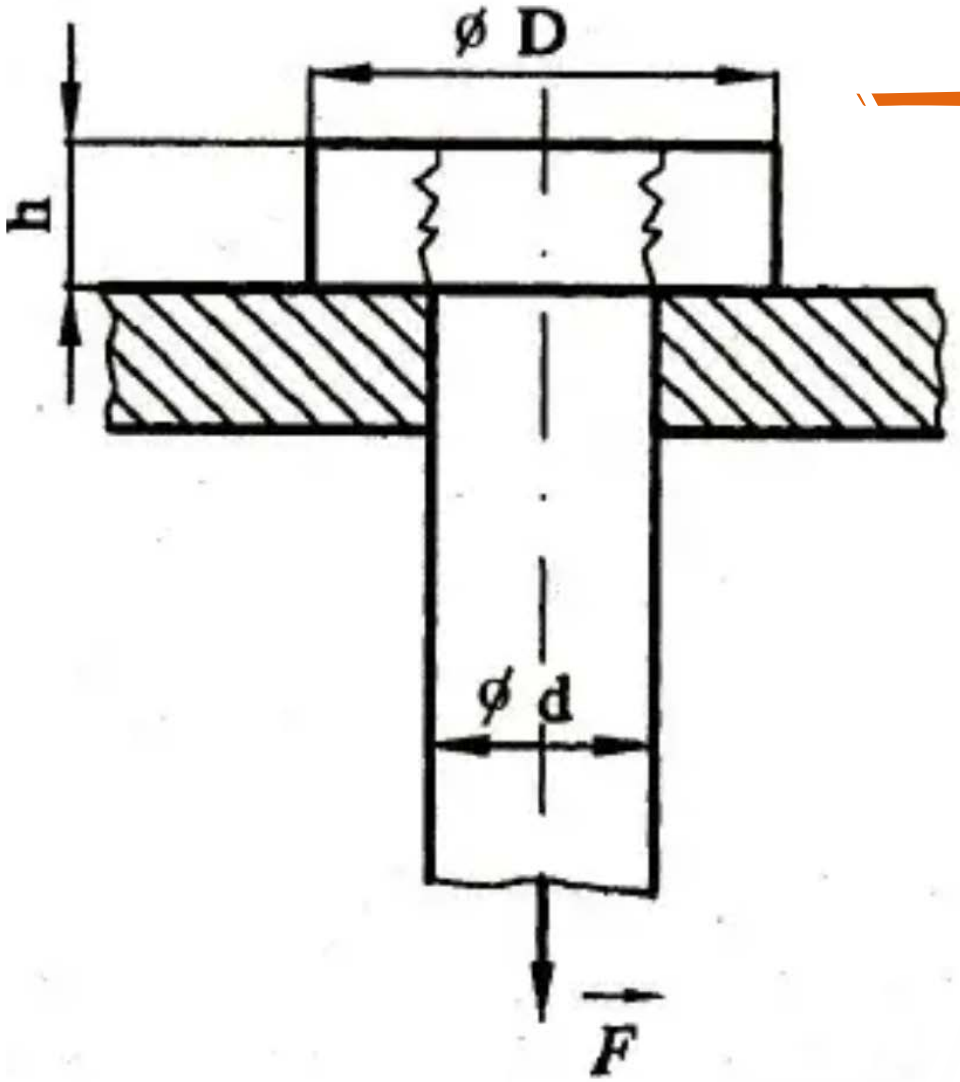




ZADACI

ZADATAK 1.



- Kraj štapa prečnika d oblikovan je tako da se može opteretiti aksijalnom silom zatezanja. Potrebno je odrediti visinu h, tako da se štap može opteretiti maksimalnom silom zatezanja, ako je prečnik štapa d = 4 cm i D=5.7 cm, dozvoljeni napon na zatezanje $\sigma_{doz} = 10\ \frac{kN}{cm^2}$, dozvoljeni napon na smicanje $\tau_{doz} = 7\ \frac{kN}{cm^2}$

ZADATAK 1.

$$\sigma_s = \frac{F}{A} \leq \sigma_{doz}$$

$$F \geq A_z * \sigma_{doz}$$

$$A_z = \frac{d^2\pi}{4} = 12.56\ cm^2$$

$$F = A_z * \sigma_{doz} = 12.56 * 10 = 125.6\ kN$$

$$\tau_s = \frac{F_t}{A} \leq \tau_{doz}$$

$$A_s \geq \frac{F_t}{\tau_{doz}}$$

$$A_s = D * \pi * h$$

$$A_s = 12.56 * h$$

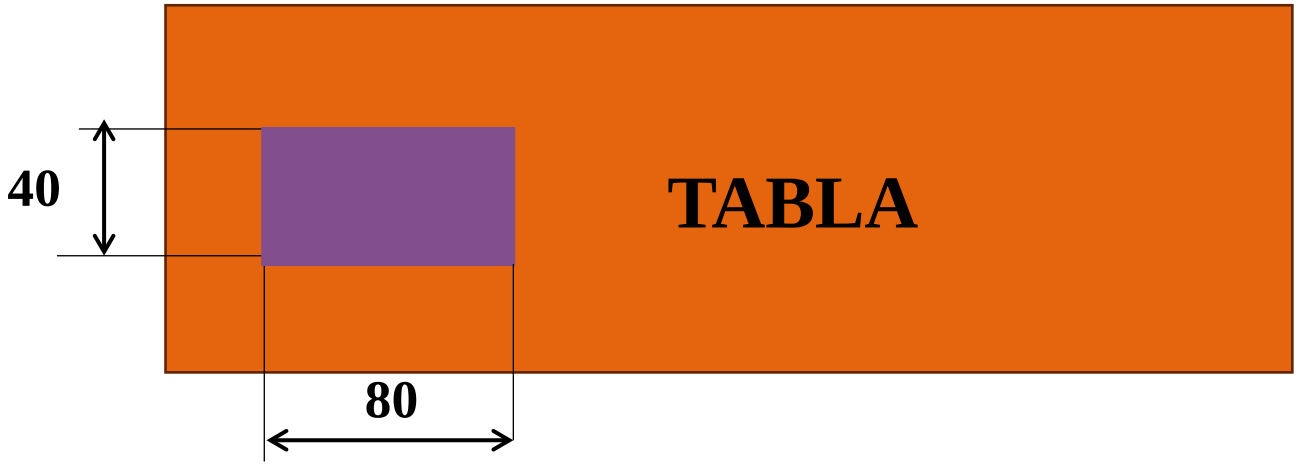
$$12.56 * h \geq 17.94$$

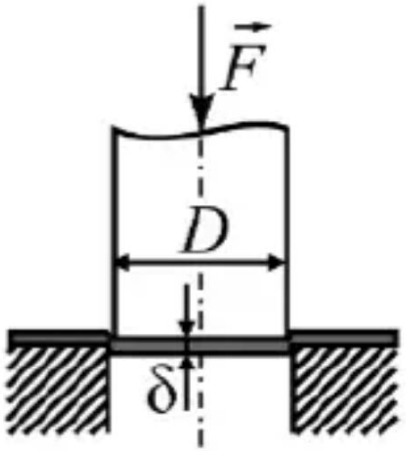
$$h \geq 1.43\ cm$$

$$h \approx 1.5\ cm$$

ZADATAK 2.

- Iz table lima debljine 2.5mm potrebno je udarcem iseći pravougaonik 40x80mm, odrediti potrebnu silu za probijanje ako je $\tau_{doz} = 30\ \frac{N}{cm^2}$.





ZADATAK 2.

$$\tau_s = \frac{F_t}{A} \leq \tau_{doz}$$

$$A_s = O_p * \delta$$

$$A_s = (2 * 8 + 2 * 4) * 0.25$$

$$A_s = 6\ cm^2$$

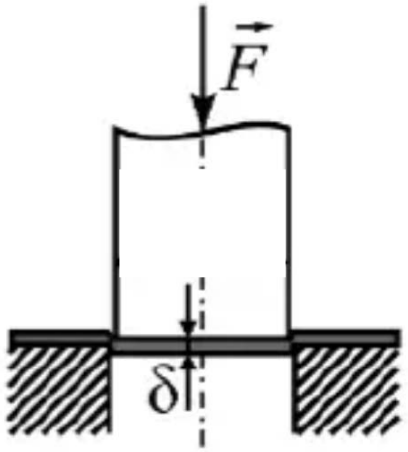
$$F \leq A_s * \tau_{doz}$$

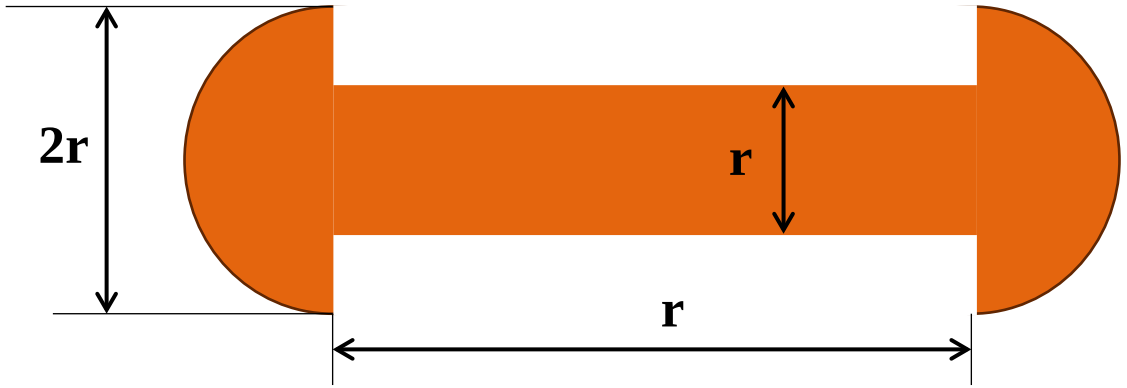
$$F \leq 30 * 6$$

$$F \leq 180\ kN$$

ZADATAK 3.

- Odrediti silu pritiska prese F, koj je potrebna za presecanje debljine 0.2cm, ako je čvrstoća na smicanje materijala lima je $\tau_{doz} = 3\ \frac{kN}{cm^2}$ $i\ r = 10cm$. Oblik kontrure predemeta izrađenog prosecanjem je dat na slici.





ZADATAK 3.

$$\tau_s = \frac{F_t}{A} \leq \tau_{doz}$$

$$A_s = O_k * \delta$$

$$A_s = (2r\pi + 2r + 4 * \frac{r}{2}) * \delta$$

$$A_s = 20.56\ cm^2$$

$$F \geq A_s * \tau_{doz}$$

$$F \geq 20.56 * 3$$

$$F \geq 61{,}68\ kN$$

ZADATAK 4.

Iz trake veličine 1000x50x3mm od čelika sa dozvoljenim naprezanjem $\tau_{doz} = 450\ \frac{N}{mm^2}$, dobija se pločica 50x50x3mm sa otvorom prečnika 30mm u sredini, postupkom probijanja i prosecanja. Iz jednog koraka trake dobijaju se dva komada prema slici:

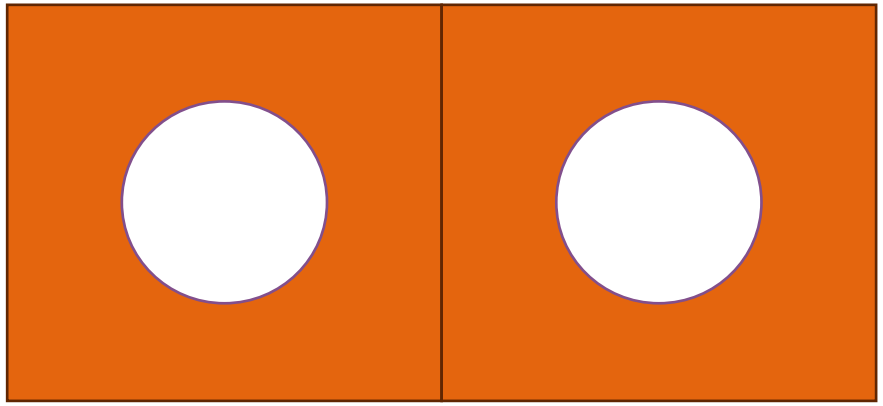
Odrediti:

a) Silu probijanja otvora,

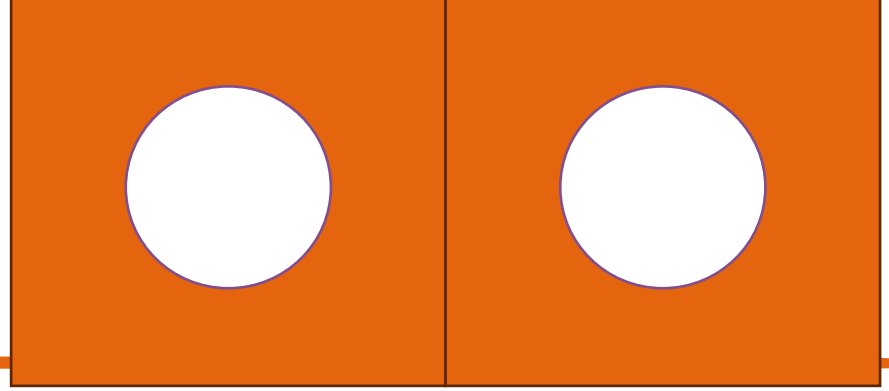
b) Silu presecanja konture,

c) Pritisak probojca,

d) Pritisak prosekača.



ZADATAK 4.



Sila probijanja otvora:

$$\tau_s = \frac{F_1}{A_S} \leq \tau_{doz}$$

$$F_1 \geq A_s * \tau_{doz}$$

$$A_s = 2 * O_K * \delta$$

$$O_K = 2r\pi = 2 * 15 * 3{,}14 = 30\pi\ mm$$

$$A_s = 2 * 30\pi * \delta$$

$$A_s = 565{,}2\ mm^2$$

$$F_1 \geq A_s * \tau_{doz} = 254{,}340\ N$$

Sila prosecanja konture pločice:

$$F_2 \geq A_{s2} * \tau_{doz}$$

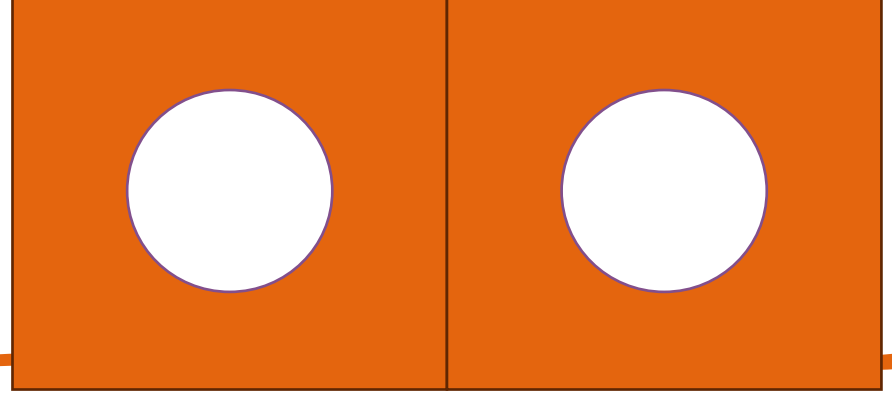
$$A_{s2} = (50 + 50) * \delta$$

$$A_{s2} = 100 * 3$$

$$A_{s2} = 300\ mm^2$$

$$F_2 \geq 135000N$$

ZADATAK 4.



Pritisak probojca:

$$\sigma = \frac{F_1}{2A_{p1}} \leq \sigma_{doz}$$

$$A_{p1} = \frac{d^2\pi}{4}$$

$$A_{p1} = \frac{30^2\pi}{4} = 706{,}5\ mm^2$$

$$\sigma = \frac{F_1}{2A_{p1}} = \frac{254{,}34}{2 * 706{,}5}$$

$$\sigma_1 = 180\,\frac{N}{mm^2}$$

Pritisak prosekača:

$$\sigma_2 = \frac{F_2}{A_{p2}} \leq \sigma_{doz}$$

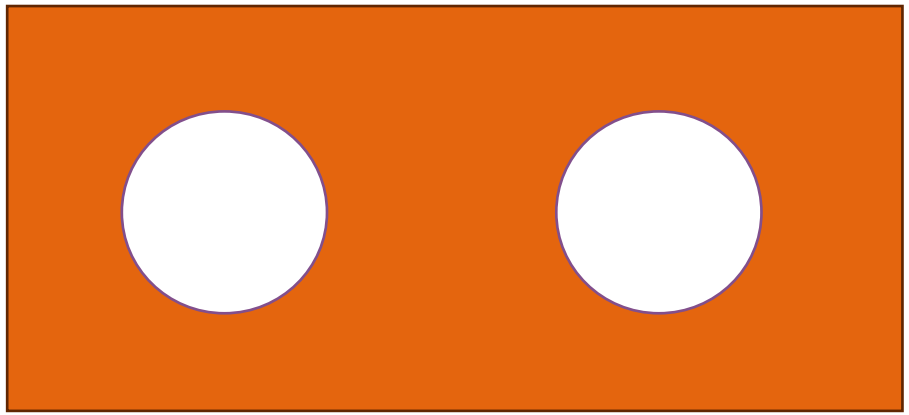
$$A_{p2} = 50 * 50 = 2500\ mm^2$$

$$\sigma_2 = \frac{135000}{2500}$$

$$\sigma_2 = 54\,\frac{N}{mm^2}$$

ZADATAK 5.

Iz pravougaone limene ploče debljine 3.5 mm potrebno je probijanjem dobiti 2 otvora koja su prečnika 20mm. Izračunati silu potrebnu za probijanje ako je $\tau_{doz} = 0.032\ \frac{MN}{cm^2}$.



ZADATAK 5.

$$\tau_s = \frac{F_t}{A} \leq \tau_{doz}$$

$$F \leq A_S * \tau_{doz}$$

$$A_s = 2r\pi * \delta = 2 * 20\pi * 2 \ = 80\pi \ mm^2 \ = 2{,}512 \ cm^2$$

$$F \leq 0{,}032 * 2{,}512 \leq 0{,}080384 \ MN$$

$$F \leq 8{,}0385 * 10^4 N$$

HVALA NA PAŽNJI!